DOCUMENT RESUME

ED 361 252 SO 023 021

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TITLE Using Art To Teach Science.
INSTITUTION National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
PUB DATE May 84
NOTE 23p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Art; *Art Activities; Art Materials; *Creativity; Elementary Education; Elementary School Science; Instructional Improvement; *Interdisciplinary Approach; *Problem Solving; Science Curriculum; *Science Instruction; Teaching Methods
IDENTIFIERS Dioramas; Globes

ABSTRACT

This booklet describes 14 student art projects to be used in science classes. Creative skills involved in the process of artistic expression seem to translate very well into the problem solving world of technology. Even in the elementary level it can help build confidence, as well as the development of abstract skills that so often lead to concepts and conclusions. The first project consists of building dioramas in which the third dimension plus imagination and a few facts are combined in a box to make parts of the universe more immediate and real. Another allows students to construct globes of planets in the solar system. A mural project is described in which each grade is assigned a place in the solar system. Other projects suggest that students attempt to draw what various events like the ice age, comets, and asteroid collisions might have looked like from space or earth, design space habitats, or how their classroom could function without gravity. Patches from six space flights are pictured with suggestions for events that students could design patches for. Imagination exercises are included dealing with scientific subjects. Instructions are given for making a book in which the students fill in the pages. Ideas for creative writing, observations with instruments such as a telescope or binoculars, and photography are suggested. Descriptions of planets and moons are the basis for creating landscapes. All of the projects listed are complete with instructions, and suggestions. Many projects include lists of necessary materials and supplies. (DK)

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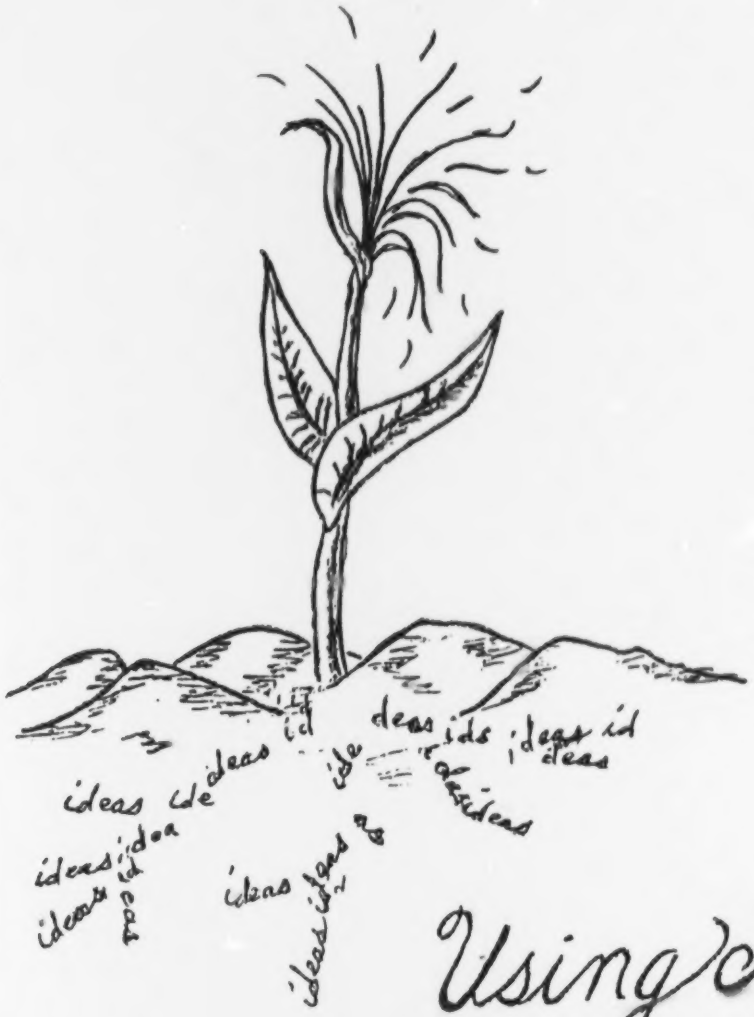

Using Art to Teach Science

AEROSPACE EDUCATION SERVICES PROJECT
NASA LEWIS RESEARCH CENTER
CLEVELAND, OHIO

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USING ART TO TEACH SCIENCE

The creative skills involved in the process of artistic expression translate very well into the problem solving world of technology.

Even in the elementary level it can help build confidence, as well as the development of abstract skills that so often lead to concepts and conclusions.

The ideas in Using Art to Teach Science are the result of feedback from many instructors. I would especially like to thank Sue Schmidt of Burnsville, Minnesota, and Jackie Rens of Little Falls, Minnesota. Their ideas as well as their classrooms are an inspiration for much of this book.

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May 1984

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DIORAMAS

Here the third dimension plus imagination and a few facts are combined in a box to make parts of the universe more immediate and real. To create an alien landscape in your room, you will need the following supplies:

A box such as a shoebox or small packing box
Paints
Reference materials
Scissors
Pencil
Imagination

EXAMPLES:

MARS — By using the photos returned by the Viking Landers, we know Mars to be a planet of red rocks and pink skies (daytime only). But these landers landed in very flat, dull (but safe) areas. The rest of Mars offers some interesting geography.

Through the use of orbital pictures, we find Mars is a planet with large valleys (Valles Marineris) which, if placed on Earth, would stretch coast to coast in America.

Also found were gigantic volcanoes like Olympus Mons, three times higher than Mt. Everest.

The Polar Regions would be somewhat like a winter landscape but with pink skies.

MOON — The Apollo flights returned hundreds of surface photos showing a gray world with rounded hills and mountains. Remember to keep the sky black, as the moon has no atmosphere, and to place a crescent Earth in the sky.

MERCURY — As this planet lacks an atmosphere, it resembles our moon, so it probably has smooth rounded hills. However, the day-time sky has a much larger sun and, once in a while, spectacular views of comets.

OTHER OBJECTS

The icy moon of Jupiter and Saturn offer views of their parent planets in the dark sky. A real challange would be Io, with its erupting sulphur (blue) volcanoes and a surface that looks like a pizza. The other moons would resemble winter landscapes.

RESOURCES Books on the Apollo and Viking missions
Astronomy and Odessy Magazine
Our Universe by National Geographic Magazine
Slides of Viking and Apollo missions are available, request information packet from:

Teacher Resource Room
M.S. 8-1 VIC
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Cleveland OH 44135

Don't forget! Display cases can become large Dioramas

R. A. Winrich

WORLDS

MODELS OF THE SOLAR SYSTEM

We have all seen globes of the Earth and Moon in classrooms and libraries. This is a chance to construct globes of some of the other members of our solar family.

Materials:
- Medium sized rubber balls, 6 to 8 inches in diameter
- Newspapers, non-colored sections
- White paint for the base
- Colored paints for surface features
- Glue
- Photographs of planetary surfaces, their moons and the Sun
- Patience

Tear or cut the newspapers into strips about one inch wide and glue to the surface of the ball in one direction. Allow a day to dry , then repeat the covering process, only glueing the strips in the other direction. Be sure to use plenty of glue.

You may want to make your own glue. There are some excellent recipes in a book by Helen Sattler titled "Recipes for Art and Craft Materials".

After several layers of strips have been fixed to your globe, allow a day or two more to dry completely and then cover with several coats of white paint for your base. Once this base has dried, you are ready to use the colored paints to create whatever world you want.

Some objects will be harder than others to reproduce. Jupiter and Saturn have colorful cloud top features and render themselves well to paints. Remember to cut the brilliant colors with some white as to make them more realistic. Mars and Mercury will be a challange as they have numerous surface features. Don't overlook the Sun as a subject with a few spots of solar activity. Smaller balls can be covered with thinner strips, and with time, they can become some of the moons of Jupiter or Saturn. Remember, these are not to scale.

MURALS

Murals involve the entire classroom; everyone has a part in the project. In some cases the entire school gets involved. A small school located in the western part of Wisconsin had the entire school taking part. Each grade was assigned a place in the Solar System.

First grade was the moon with a black sky, some playground pieces on a gray/white surface, and in the sky, a crescent Earth.

Second grade was Mars with a pink sky and the front steps of the school leading down to a rocky, sandy surface in all shades of red.

Third grade was Venus -- no sky, just shades of yellow and a corner of the school building at one edge.

Grade 4 was Jupiter with the school becoming another moon.

Grade 5 was Saturn with the school as another moon.

Each mural was painted on a long strip of brown paper and hung so as to cover a large part of one wall. Everyone had a part of the picture and could point with pride to that section. The rooms were renamed the Lunar Room, the Mars Room, etc. The hallway was renamed the Earthview Section, showing the midwest from about 500 miles up, with the Great Lakes. In each room was a chart showing the weight of the students on Earth and on the object of that room.

R. A. Winrich

PALEOPROJECTIONS

We have all seen pictures depicting life during the age of the dinosaurs. These views often depict a scene from some long lost swamp. But imagine what it all looked like from space.

Imagine the ice age, or countless other events. The following are but a few paleoideas to get the wheels turning. It has possibilities to open a whole new door. . . .

*

Some scientists now think that the reason the dinosaurs died out so suddenly was due to a comet striking the Earth. Imagine such an impact as seen from three hundred miles up. Don't worry about the recognition of landscape -- the present landforms were not around at that time.

*

The year is 1178, the place Canterbury, England. Here records indicate Canterbury monks may have witnessed a rare event -- the Moon was struck by a small asteroid. During the Apollo flights a very fresh impact feature was noted and named which might support their claim. Imagine what such an event might look like from the Earth, or from Lunar orbit.

*

The year 837. Europe is locked in what historians will someday call the Dark Ages. But in that year it wasn't quite so dark. Comet Halley made its closest approach to the Earth in 2,000 years and it blazed across the sky brighter than anything except a full moon. Imagine what it must have looked like to people living at that time. Remember to keep the landscape realistic. How about such a view at the unique angle provided from low Earth orbit?

*

Tunguska, 1908. Here in Siberia, a tiny comet levels the landscape in an explosion that rivels the largest of atomic devices today. Imagine such an event as seen from low Earth orbit, or perhaps an airplane flying at 35,000 feet and some 100 miles away.

*

The Ice Age. Scientists say several times in the recent geologic past, glaciers advanced over the midwest areas of the United States. The last stage had several small surges and left in its wake the Great Lakes. Imagine what some of these stages might have looked like from 300 miles up with the vast expanse of ice in the north and overhead perhaps an Aurora display.

*

The geologic past is rich with clues, and theories abound as to the lay of the land. There are many texts that contain maps of the defined geologic eras. Imagine what Earth views might have looked like from 300 miles up, or from a stationary weather satellite 22,500 miles in space.

*

How to Make a Lunarscape out of Yourscape

This is a process of subtraction and works best with linedrawings. very little color is needed as the lunar surface is mostly variations of gray.

Select your landscape. It helps if the area you selected has some relief to it, hills or valleys in it. Remove the following elements.

Blue Sky. Lunar skies are black even in the daytime as there is no atmosphere to scatter the sunlight.

Vegetation. Remove anything green, no trees, shrubs, grass. No green on the moon unless you put it there.

Water. Remove any lakes,streams,rivers or ponds. No water could exist in the conditions that exist on the lunar surface. Replace any large bodies of water with a smooth planed area and add alot of little craters and tons of boulders.

Round out any hills or mountains you have. There are no sharp edges on the moon.

Remove all signs of civilization. Take out any buildings, highways, bridges, and ofcorse people unless you put them in a suit. Take out all living things, no Fido or Garfields allowed. (unless you put them in a spacesuit.)

Don't forget to litter your landscape with lots of small craters and lots of various sized boulders.

Geographical challanges

Try lunarscaping the following areas:

- Glacier National Park
- Yellowstone National Park
- New York City
- Mt. what-ever...any good looking mountain
- Try turning one of the Great Lakes into a Lunar Sea.

If the color Gray doesn't excite you, switch to Red, add pink to your sky, take away most of your craters but keep in the boulders in fact add even more and fill in the spaces between these rocks with pink sand. You are now on Mars!

VIEW FROM ABOVE

There is a new type of artist emerging these days, the artist who works with the theme of Orbital Art. Some of the best in this field include former astronaut Alan Bean and the Cosmonaut Leonov, who have put their experiences on paper showing us the view from above.

However, it is not necessary to have to go into orbit to capture these elements. By viewing some of the thousands of photographs and using an atlas plus a little imagination, one can translate some of the same views. Here are some possibilities to consider.

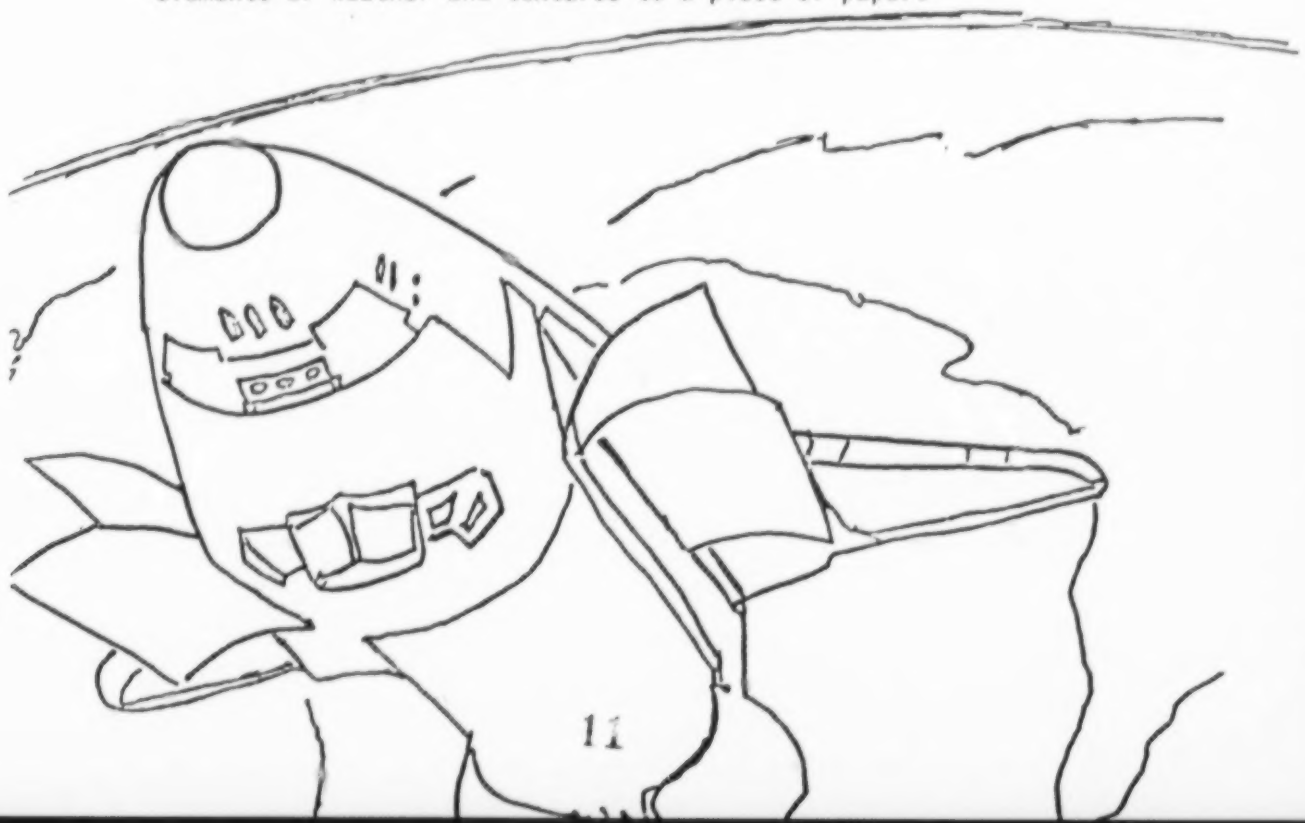
The Great Lakes. Any one or a combination of lakes. Remember these lakes create their own climates. It is seldom clear over the entire system. A challange might be right at sunset over Chicago with the lights of Detroit and smaller towns beginning to show.

Florida. There are lots of good photographs of this area from different altitudes.

Hawaii. Another subject that has been photographed to help.

These are but a few selected areas. Any area where there is contrast between the elements of land and water are possible subjects. Don't everlook the elements of nature, a tropical storm or the Northern Lights as seen from space -- and don't forget the entire system including moon as perhaps seen by a crew on the way to Mars.

One method suggested by several teachers is to take a state map and work with the idea of curving it as one would see the Earth from a little over 100 miles in orbit. Then work with the imagination to project the elements of weather and textures to a piece of paper.



HABITAT

A DESIGN CONCEPT: SPACEAGE ARCHITECTS

Over the past decade we have witnessed the emergence of space travel and the beginnings of space living, humans in space for long periods of time. But these early dwelling places will someday perhaps be viewed as rough and uncomfortable a place to live in as we view the log cabins of our ancestors. Let us take a look into the future of living in space.

*

You are assigned to help design Spacelab 7. It is to be placed in an orbit 22,500 miles out in a position directly over Cleveland, Ohio -- a position in space that as of now is not overpopulated with objects. In this lab there is to be conducted research in astronomy, materials processing, and Earth armospheric studies concerning the Aurora as well as lower atmospheric conditions. The lab is to staff 15 people at all times in shifts that generally last from one to two months. The Astronomers stay the longest.

The facility will utilize the modular approach that had been utilized from the start of space platform construction, due to the ease in which each unit could be linked up and the fact that it allows the expansion of the lab as a whole by merely adding another unit.

Keep in mind the effect of Zero-G on the living quarters when designing the eating, sleeping, and recreational areas.

*

You are selected to submit designs for the first university to be placed in orbit. Needless to say, this institution will specialize in subjects such as Astronomy and Astroengineering, as well as other high tech sciences.

The facility will be able to support research for some two hundred personnel. This must include the living quarters as well as a recreational facility and an exercise facility to help maintain proper physical conditions. These facilities need not be tied into the university as a whole, but may maintain position in orbit within a few hundred yards to allow them to be unique in their own way.

Keep in mind the interiors of each unit based in its function. Remember Zero-G when any movement of the personnel is involved.

*

The following materials can be used to support the concept of Zero-G and give the student an insight into some of its problems:

Films: Zero-G HQ 260A -- 15 minutes
Fluids in Weightlessness HQ 2600 -- 15 minutes

You might even want to run these films with the sound off as you view them a second time.

* * *

THE ZERO-G CLUB

Welcome to the world of Zero-G. In this world there are some special problems. There is no up or down. You find that a room has more space because you can use all of it.

To become a member of this club you must solve some problem related to everyday life. For example take your classroom, what would it be like without gravity? Where would you put your desk? Where would the teacher be? What would it be like to take Gym in space? You generate the problem and then come up (no pun intended) with the solution.

Good luck!

A good film to support this activity is called Zero-G, HQa 260A. It is a color film, 15 minutes long.

A SCIENCE THROUGH ART PROJECT

WARNING: THIS ACTIVITY IS KNOWN TO BE CONTAGIOUS!

This activity can stimulate the desire to be unique while learning from others.

THE PATCH

Each space flight was the first of some kind and a crew patch to express the objectives of the mission was designed by the members of that flight. (See following examples and perhaps study the objectives of that flight.)

Design a patch to commemorate the following events:

A. First Mars landing
B. Staff member for the space platform team
C. Staff member for the Lunar-Far Side Observatory
D. Staff member for a geological survey of the Asteroid Belt
E. First mission to another star system (pick a star)

The student should know a little bit about the object they select, and this might require some library research.

HOW TO WEAR A PLANET

There are many good pictures available from the various planetary missions that show features of these worlds. Some are works of art in themselves and would make interesting designs.

Other ideas might be an extiosion of what we have learned about these worlds. For example, imagine skiing down Olympus Mons, a mountain three times higher than Mt. Everest, located on the planet Mars.

Imagine a storm on the surface of the planet Venus, or ballooning above the great spot of Jupiter. The possibilities in our Solar system are endless.

Materials: It is recommended that you use an old t-shirt. There are many kinds of transfer materials available to color in your design. Some examples are the use of Pental, Fabricfun Pastel Dye Sticks, and Versatex Textile Paint. It is recommended that two people work on the shirt as it requires the shirt to be held fast. The dye sticks are crayons and will look like crayon coloring, so several coats may be needed for the satisfaction of the individual. If you do not use it with an old t-shirt, patches can be made out of old sheets and then sewn on. **R.A.W**

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THE THIRD EYE

We have a third eye, the inner eye that allows us to deal mentally with those things we cannot see, touch or smell. It is the inner eye of our imagination, and it may well be our most useful tool. A great thinker once remarked, "Imagination is more important than knowledge."

But how do we develop our use of this eye? Perhaps like everything else, we can develop it by exercise. Let's try this exercise, based on things that we know and understand.

Most of us have at one time or another lost a helium-filled balloon and watched it sail off into the sky. Sometimes a postcard is attached to the balloon before it is released, to be returned to the sender after a trip of hundreds of miles. Imagine what it is like to be that postcard. What would it feel like to sail over your house, clear the trees and head up into the sky. What would the view be? What would it feel like to float up into a cloud, slowly get damp, become heavy and begin to fall back to Earth. What would you see as you fell? Where would you land? Try to put these ideas into complete sentences and record your thoughts.

This exercise was based on things we may have experienced at some time in our lives. Now let's see if we can experience some things <u>out</u> of this world. To do this, you will need some background in astronomy. Perhaps this will require some reading on your part. Let's see how well we can do.

1. On July 30, 1964, Ranger 7 hit the moon. This was the first Ranger success. It transmitted back over 4,300 pictures. Imagine what it was like for Ranger.

2. Jupiter's Red Spot has been observed for hundreds of years, but we still don't understand what causes it. Imagine traveling in a balloon inside the spot. What would you see? What would the sky look like? What would it smell like?

3. What would it be like to ride along with Halley's Comet as it goes around the sun and races back to the cold depths of the solar system?

4. What would it be like to climb the slopes of Olympus Mons, the highest mountain on the planet Mars? This is a mountain three times higher than Mt. Everest.

5. What would it be like to play baseball by yourself on Phobos, a tiny moon of Mars, where the gravity is so weak that you can place a ball into orbit simply by throwing it?

6. What would it be like to be a tiny piece of ice left over from some forgotten comet and to suddenly see yourself racing towards Earth at over 60,000 miles per hour, soon to go out in a blaze of glory?

CREATE A BOOK PROJECT

Making a book is a personal project that often leaves the student with a strong sense of accomplishment and pride. Here we are simply making the book; the student fills in the pages.

Materials needed:

Cardboard	This can be the thin lightweight pressed material found at the back of a tablet or the materials that are used to make boxes.
Paper	Ditto paper or typing paper works fine and will last.
Thread	Heavier thread works best. Use at least double thread for durability.

Needles

Hat pins or sturdy large stick pins

Styrofoam or ceiling tile to push pins through paper for sewing.

Wrapping paper or contact paper for cover.

Glue and tape.

It is recommended for younger groups to have the books put together as far as the sewing part by an aide if available, to save time, energy, patience.

Decide the number of pages needed. Cut another sheet approximately one-quarter the size used for the book, for reinforcement.

Poke a minimum of 5 holes, using stick pin and styrofoam, Sew the pages together. Tie a knot on the outside of the booklet. Hide the knot in the cover's spine.

Some children prefer to write the story first to see how it will lay. Then, in the pre-made book, redo the story with illustrations. This helps teach the process of proofing a story and teaches quality control.

Select the cover material and cut it approximately 1 inch wider than the cardboard. Be sure to leave a ½ inch gap between the cardboard pieces so it will lie flat. Fold over the covers. Insert pages after glueing tab between cardboards. Glue first page over front cover tab and last page over the back cover tab. This should cover up all the rough edges.

If plain brown paper is used for the cover, the student can create an illustrated cover.

CREATE !

Creative Writing Ideas

There are many books devoted to this subject area, often they use the elements known as poetry. Here are but a few condensed possibilities to perhaps get you started...

SHAPE POETRY-Thoughts,feelings, and ideas are written in the shape of the subject...lines are not necessary to outline the subject but they might help outline the shape. ie A star, the shuttle, the moon or sun, or a rocket.

LIMERICKS A simple rhyming poem often nonsensical and humorous and has the potential to be rather disastorous.

Couplets Simple, two lines that rhyme

Hink Pinks Use of synonyms for clues to get a rhyming answer

1. Hink pink : one syllable
   ie..What is an interplanetary contest? A Space Race.

2. Hinky : Two Syllables
   Pinky ie..What is a messy landing? A crashdown splashdown

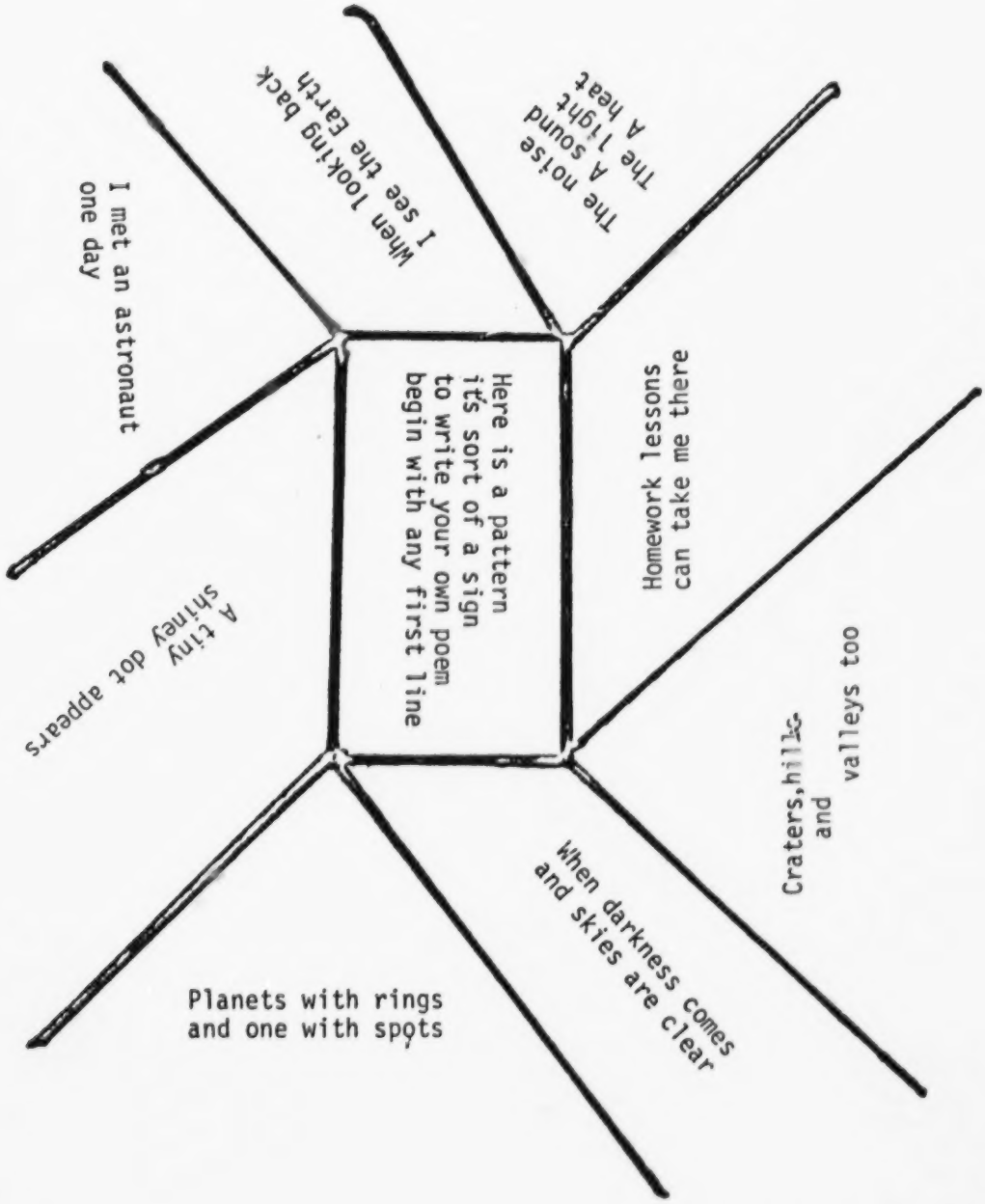
3. Hinkity : Three syllables
   Pinkity ie..What is a great Ocean? A terrific Pacific

Haiku Japanese poetry-Focusing on one specific element or aspact of nature.
Consists of three lines: 5, 7, 5 } syllables

Keen observations as well as a love for some element of nature are shown.
Each poem forms a unique word picture.

ie: All of space is cold
And feelings are all trembling
In the sudden dawn } feeling from orbit

Cinquain Five line poems with no rhyme pattern. Format...
Line one: one word, a noun
Line two: two words, describes line one
Line three: three words, action of line one
Line four: four words, your feelings about subject
Line five: two possibilities, one word same as line one or simila
or five words that tie the whole thing together.


Here is a pattern
it's sort of a sign
to write your own poem
begin with any first line
I met an astronaut
one day
When looking back
I see the Earth
The noise
A sound
The light
A heat
Homework lessons
can take me there
Craters, hills
and
valleys too
When darkness comes
and skies are clear
Planets with rings
and one with spots
A tiny
shiney dot appears

OBSERVATIONS WITH INSTRUMENTS

This has become almost a lost artform, yet before the invention of photography it was the sole method of illustrating the views of the various objects of the night sky.

To do this you will need an instrument, and in many cases, a knowledge of the night sky. Instruments need not be as expensive as large telescopes; a good pair of 7X50 or 7X35 binoculars should be adequate.

The Moon. Here is an object that has been the easiest to find and work with. Follow its progress night by night and sketch its features. The full moon presents an interesting subject -- a contrast in tints.

The Winter Sky. There are several objects to sketch here and each is easy to locate in the evening sky. But it is best if the instrument you are using is supported in some manner, so all you have to do is keep it focused and make a few movements to keep your objects in the field of view.

Objects to look for in the winter sky:

The Pleiades, located in the constellation Taurus, looks like a tiny Little Dipper. Sketch it with the unaided eye, then with your scope.

Orion, one of the largest constellations in the winter sky. Located below three bright stars that make up its belt are three fainter stars. Sketch the center one -- it is the great nebula of Orion.

If you have a larger scope at hand, try sketching the planets Jupiter and Saturn when they are visible.

The night sky isn't the only area available. The Sun is an excellent target that offers constant change. BUT NEVER VIEW THE SUN DIRECTLY. Utilize a projection method. Even a 7X35 can produce nice images when projected.

When working with night objects, try to notice the subtle differences in color. To get this on paper, it is best to use colored pencils or water colors.

PHOTOGRAPHY . . . . The Night Sky.

There are those who will argue that using a camera isn't Art! Yet many great museums show photographs in their exhibits. One of the simple things you can do with a camera is the capture of star trails. Here the options are many in terms of what film to use. If you have a darkroom, you might try various speeds of black and white emulsions to determine what is best for your effect. As a base line or standard,set your camera in a fixed position and at F5.6. Leave it open, centered on the North Star. In one hour, as the Earth completes 22½ degrees of a turn on its axis, the stars will form little parts of circles. Then go up to F8 and repeat. Finally, one more turn at F3.5. This should tell you how your film reacts to this time frame. This is more effective if done on a clear night.

Other effects can be obtained if, after ½ hour, you cover up the lens for five minutes, then uncover for the next ½ hour. The gaps can be plotted to show constellations. Then try color film.

Color films offer a variety of emulsions and it is best to stay with a fairly fast film -- ASA 100 or more. You might even try the very high speed ASA 1000 films; they offer shorter exposures and some great results. It is also recommended that you shoot a slide film for many reasons. For one, it's cheaper to edit, and for another, you can use the slide to make inter-negatives for large prints, either in black and white or in color.

Optional Targets: Meteor Showers. Here, a fast film is a must. For best results you want short exposures of about 10 minutes up to about 30 minutes. Here is a list of prominent meteor showers:

Name	Peak Date
Quadrantids	January 3
Virginids	March 13
Lyrids	April 21
Aquarids	May 4
Persaids	August 12
Orionids	October 22
Geminids	December 14

Photographing the sun can be tricky. If you have a telephoto lens or even a good pair of binoculars, try catching the sunset when it is a dark red. Try to silhouette some object like a tree or a friend. Don't be discouraged if the sun is too hard. Try the full moon. Many excellent shots have been turned out by the rising moon.

Needless to say, photography is an important scientific tool, but its results can be quite artistic.

R.A.W. '84

WELCOME TO TITAN
AN EXPERIMENT IN ALIEN LANDSCAPES

Space landscapes are a relatively new art form. The people who draw what it would be like on the moon or Mars for a living are a select few. However, more and more people are turning to illustrating what we have learned about the worlds around us. That number even includes a man who walked on the moon.

But you don't have to go into space to imagine what it must be like. All you need are a few facts and your powers of imagination. Here are some ideas:

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Titan is unique among the moons of the Solar System. It has an atmosphere and probably has weather, but not like any weather here on Earth. On Titan it may rain methane and snow methane, there may even be rivers and lakes or glaciers made up of methane. This is truly a world of no smoking! Imagine flying over the landscape in an ultralight -- what would your view be like? Remember, you are almost a billion miles from the sun, so the light will be a little weak. Keep in mind the Voyager pictures showing the upper atmosphere to be orange in color, so everything would have an orange tint to it.

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Mars is a world that awaits. Perhaps sometime early in the 21st Century people will walk on its surface. And what a strange surface it is. After researching this object, imagine you are sitting on top of one of its ancient volcanoes with the land below. What would it look like? Imagine your ultralight flying down some large valley (it better have extra large wings for the air there is very thin). Imagine flying over one of the polar regions. Would it resemble our own polar areas?

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Jupiter is a world of savage beauty. Imagine floating above Amalthea, one of the inner moons. Amalthea is unique. It is bright red in color, and from its orbit, Jupiter would fill over half of the sky.

Io is the next moon out from Jupiter. It is the only yellow and brown moon known so far, and it is unique in that it has active volcanoes that at times send material (sulphur compounds) over a hundred miles into the sky. What would one of these eruptions look like from a distant hill? Remember to place Jupiter in the sky. What would it look like when Jupiter eclipses the sun? What does Jupiter look like with the sun hidden behind it? Jupiter has gigantic lightning storms and Aurora similar to those seen above out own planet.

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Background: Titan: Voyager pictures are about what we have so far, and all they show are an orange fuzzy ball.
Mars: Film Planet Mars, HQ 283, runs 28½ minutes and gives an excellent background of that object.
Jupiter: Voyager images.

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Don't forget the Earth. All you need is a good atlas and the idea of viewing a curved surface so objects like the Great Lakes don't just lie flat. Keep in mind that it is seldom clear over a large area unless you picked the great deserts or the Polar areas. Select your own altitude.